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(54)【発明の名称】衛星航法装置

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【特許請求の範囲】

【請求項１】移動局内に人工衛星から送られてくる高周波信号を受信する回路と、その受信信号からパラレルな航法データを復調する処理回路であってメモリにパラレルな航法データを記憶し読み出す手段、およびデータ要求コマンド並びに航法データをインターフェース回路との間で入出力する手段を備えた該処理回路と、パラレルな航法データを記憶する該メモリと、パラレルな航法データをシリアルな航法データに変換し、シリアルな航法データをパラレルな航法データに変換する該インターフェース回路と、そのシリアルな航法データを送受信する回路とを有し、

固定局内に人工衛星から送られてくる高周波信号を受信する回路と、その受信信号からパラレルな航法データを復調する処理回路であってメモリにパラレルな航法データを記憶し読み出す手段、およびデータ要求コマンド並びに航法データをインターフェース回路との間で入出力する手段を備えた該処理回路と、パラレルな航法データを記憶する該メモリと、パラレルな航法データをシリアルな航法データに変換し、シリアルな航法データをパラレルな航法データに変換する該インターフェース回路と、そのシリアルな航法データを送受信する回路とを有し、

前記移動局と前記固定局が相互にシリアルな航法データを送受信可能なことを特徴とする衛星航法装置。

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【発明の詳細な説明】

〔産業上の利用分野〕

本発明は、例えば自動車、列車など移動する運行体で衛星から信号を受信し、運行体の位置を演算し表示することのできる衛星航法装置に関するものである。

[Title of the Invention] SATELLITE NAVIGATION SYSTEM

[Claim]

[Claim 1] A satellite navigation system characterized in that it has in a mobile station: a circuit for receiving a high-frequency signal sent from a man-made satellite; a processing circuit for demodulating parallel navigation data from that received signal, the processing circuit having means for storing and reading out parallel navigation data to and from a memory and means for inputting and outputting data request commands and navigation data to and from an interface circuit; said memory, which is for storing parallel navigation data; said interface circuit, which is for converting parallel navigation data into serial navigation data and converting serial navigation data into parallel navigation data; and a circuit for transmitting and receiving that serial navigation data; and has in a fixed station: a circuit for receiving a high-frequency signal sent from a man-made satellite; a processing circuit for demodulating parallel navigation data from that received signal, the processing circuit having means for storing and reading out parallel navigation data to and from a memory and means for inputting and outputting data request commands and navigation data to and from an interface circuit; said memory, which is for storing parallel navigation data; said interface circuit, which is for converting parallel navigation data into serial navigation data and converting serial navigation data into

parallel navigation data; and a circuit for transmitting and receiving that serial navigation data, in addition to which the mobile station and the fixed station can transmit and receive serial navigation data to and from each other.

[Detailed Description of the Invention]

[Industrial Field of Application]

This invention relates to a satellite navigation system with which it is possible to receive a signal from a satellite in a moving vehicle, such as for example a car or a train, and compute and display the position of the moving vehicle.

[Prior Art]

Satellite navigation systems have included those called GPS (Global Positioning System) navigation systems, with which a moving vehicle, for example a car or a train or the like, receives four high-frequency signals from four man-made satellites and carries out demodulation of navigation data from the four signals and measurement of apparent distances. And it displays the present position of the mobile body obtained from the navigation data and the apparent distances. Among this navigation data, the demodulation of efemeris data (orbit data and clock characteristic data of individual satellites) takes 18 seconds. And because the demodulation of almanac data (compressed orbit data and clock characteristic data of all the satellites) takes 12 seconds per page, for all the pages (25 pages) it takes 300 seconds. Also, when the mobile body is

traveling in a city area, the signals from the satellites are blocked by obstructions such as buildings, the reception of data signals is interrupted; and it takes a great deal of time for the complete data to be demodulated. Thus there has been the shortcoming that during this period position determination is impossible, and the finally displayed position of the mobile body is incorrect.

[Problems that the Invention is to Solve]

The present invention was made to resolve the above-mentioned shortcoming of satellite navigation systems of related arts, and provides a satellite navigation system which can rapidly and reliably demodulate navigation data even when the mobile body is traveling in an area where there are many obstructions, such as a city area or a mountainous area.

[Means For Solving the Problems]

A satellite navigation system of the present invention which solves the above-mentioned problem will be described using Fig. 1, which corresponds to an embodiment.

The satellite navigation system of this invention has a mobile station 1 mounted on a mobile body (not shown) and a fixed station 2 provided with an antenna 21 in a place where there are no obstructions. Inside the mobile station 1 are a circuit 12 for receiving a high-frequency signal sent from a man-made satellite, a processing circuit 13 for demodulating parallel navigation data from this received signal, a memory 14 for

storing parallel navigation data, an interface circuit 15 for converting parallel navigation data into serial navigation data and converting serial navigation data into parallel navigation data, and a circuit 17 for transmitting and receiving this serial navigation data. Inside the fixed station 2 are a circuit 22 for receiving a high-frequency signal sent from a man-made satellite, a processing circuit 23 for demodulating parallel navigation data from this received signal, a memory 24 for storing parallel navigation data, an interface circuit 25 for converting parallel navigation data into serial navigation data and converting serial navigation data into parallel navigation data, and a circuit 27 for transmitting and receiving this serial navigation data.

[Operation]

Parallel navigation data received by the mobile station 1 and demodulated by the processing circuit 13 is converted to serial navigation data by the interface circuit 15 and parallel navigation data received by the fixed station 2 and demodulated by the processing circuit 23 is converted to serial navigation data by the interface circuit 25, and the respective serial navigation data can be transmitted and received between the mobile station 1 and the fixed station 2 through the transmitting/receiving circuit 17 and the transmitting/receiving circuit 27.

[Embodiment]

Fig. 1 is a block diagram of an embodiment of a satellite navigation system to which the invention has been applied. A mobile station 1 of the satellite navigation system is loaded on a mobile body such as a car, and an antenna 11 for receiving signals from satellites is mounted on an external part, for example the roof, of the mobile body. The mobile station 1 also has a receiving circuit 12, a processing circuit 13, a memory 14, a parallel-serial interface circuit 15, a display 16 and a transmitting/receiving circuit 17. The fixed station 2 transmits and receives navigation data to and from the mobile station 1 of the mobile body as it travels in the communication territory of the fixed station 2. The receiving circuit 12 is a circuit for amplifying satellite signals received from man-made satellites. The processing circuit 13 is a circuit for demodulating parallel navigation data from these received signals, and has a function of storing and reading out parallel navigation data to and from the memory 14 and a function of inputting and outputting data request commands and parallel navigation data to and from the parallel-serial interface circuit 15.

The fixed station 2 is provided with an antenna 21, which is set up in a location with clear sight lines and receives signals from man-made satellites. The fixed station 2 also has a receiving circuit 22, a processing circuit 23, a memory 24, a parallel-serial interface circuit 25, a display 26 and a

transmitting/receiving circuit 27. The receiving circuit 22 is a circuit for amplifying satellite signals received from four man-made satellites. The processing circuit 23 is a circuit for demodulating parallel navigation data from these received signals, and has a function of storing and reading out parallel navigation data to and from the memory 24 and a function of inputting and outputting data request commands and parallel navigation data to and from the interface circuit 25.

In the fixed station 2, high-frequency signals from four in-sight satellites are received by the antenna 21 and demodulated into navigation data by the receiving circuit 22 and subjected to processing such as bit synchronization and then stored in the memory 24 by the processing circuit 23.

The antenna 11, the receiving circuit 12, the processing circuit 13 and the memory 14 in the mobile station 1 also operate in the same way as the corresponding parts of the fixed station; however, when the mobile body is traveling in a city area or the like, there are times when because the signals from the satellites are blocked by obstructions such as buildings and the navigation data in the memory 14 is not updated, it becomes old data. Because of this, when the power supply of the display 16 is turned on, the processing circuit 13 executes reception processing in accordance with the procedure of the flow chart shown in Fig. 2.

In a step 101, it is checked whether or not the navigation

data in the memory is new. If it is new, signal processing is carried out and the navigation data is displayed on the display 16. When it is old, a data request command is sent from the parallel-serial interface circuit 15 to the fixed station 2 through the transmitting/receiving circuit 17 (step 102). Data is then sent from the fixed station 2 and reception of navigation data is completed in step 103, whereupon the navigation data in the memory 14 is updated in step 104.

The processing circuit 23 in the fixed station 2 executes reception processing in accordance with the procedure of the flow chart shown in Fig. 3. When in a step 201 the processing circuit 23 receives a data request command through the transmitting/receiving circuit 27 and the interface circuit 25, in step 202 navigation data in the memory 24 is taken out.

This parallel navigation data taken out is converted to a serial signal by the interface circuit 25 and transmitted through the transmitting/receiving circuit 27 to the mobile station 1 (step 203).

In the mobile station 1 serial navigation data received through the transmitting/receiving circuit 17 is converted by the interface circuit 15 to parallel signal navigation data, and the processing circuit 13 stores this navigation data in the memory 14. In this way the record is updated from old navigation data to new navigation data.

Using this new navigation data the processing circuit 13

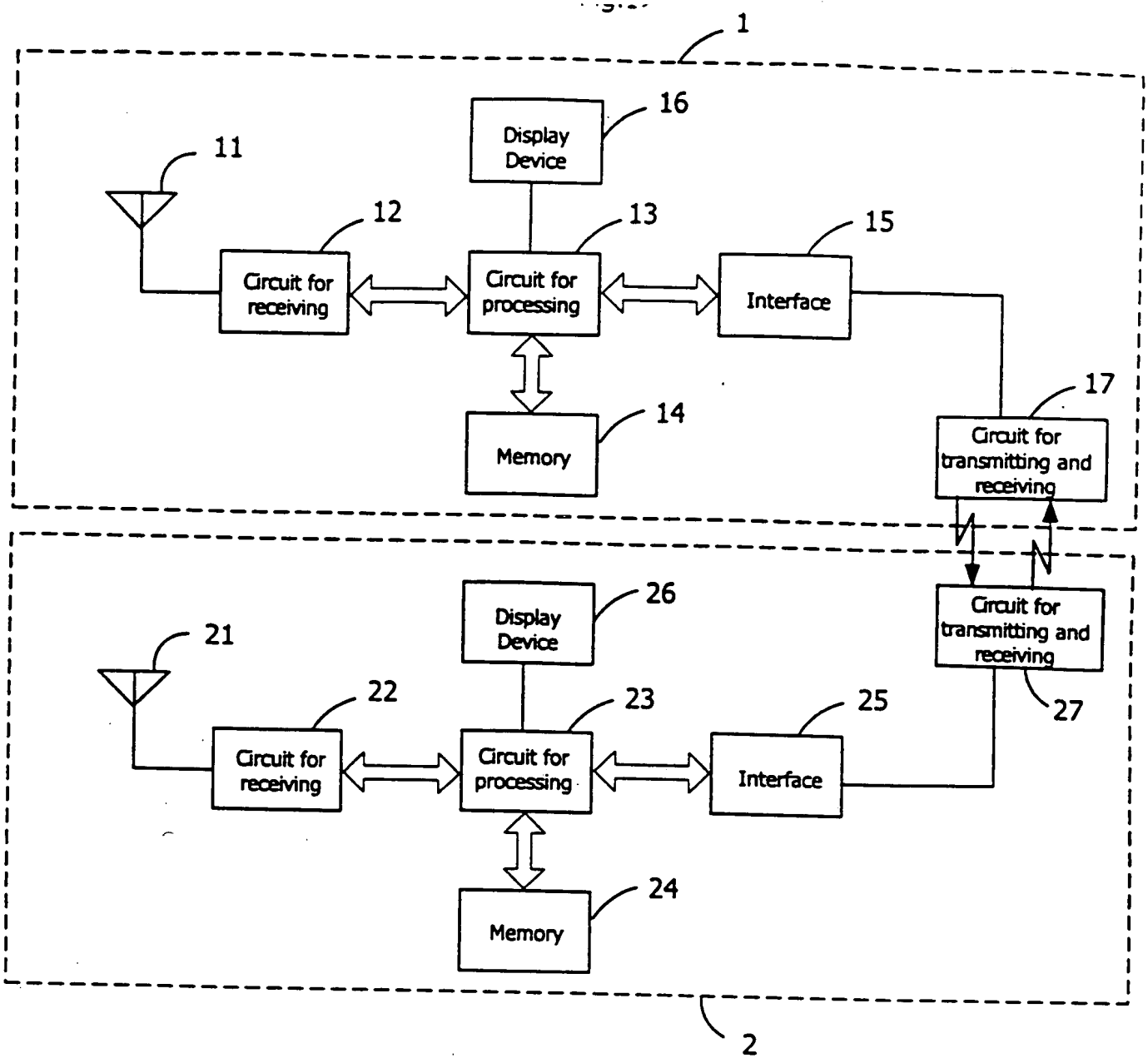
selects a satellite and with the receiving circuit 12 receives a signal from the selected satellite inputted from the antenna 11 and measures an apparent distance. The processing circuit 13 combines this apparent distance with navigation data to compute the position of the mobile station 1, that is, of the mobile body. The computed position of the mobile body is displayed on the display 16.

A wireless connection or a telephone line routed via a wireless connection is used for the connection between the transmitting/receiving circuit 17 of the mobile station 1 and the transmitting/receiving circuit 27 of the fixed station 2. Depending on the type of the mobile body, they may alternatively be connected by a cable. The fixed station 2 is not limited to an installation fixed on the ground, and may be another mobile station which has already finished collecting or receiving navigation data, in which case a display 26 for displaying the position of that mobile station itself becomes necessary. And the fixed station 2 may also be a relay station which has only the function of transmitting and receiving navigation data and does not itself receive signals from satellites.

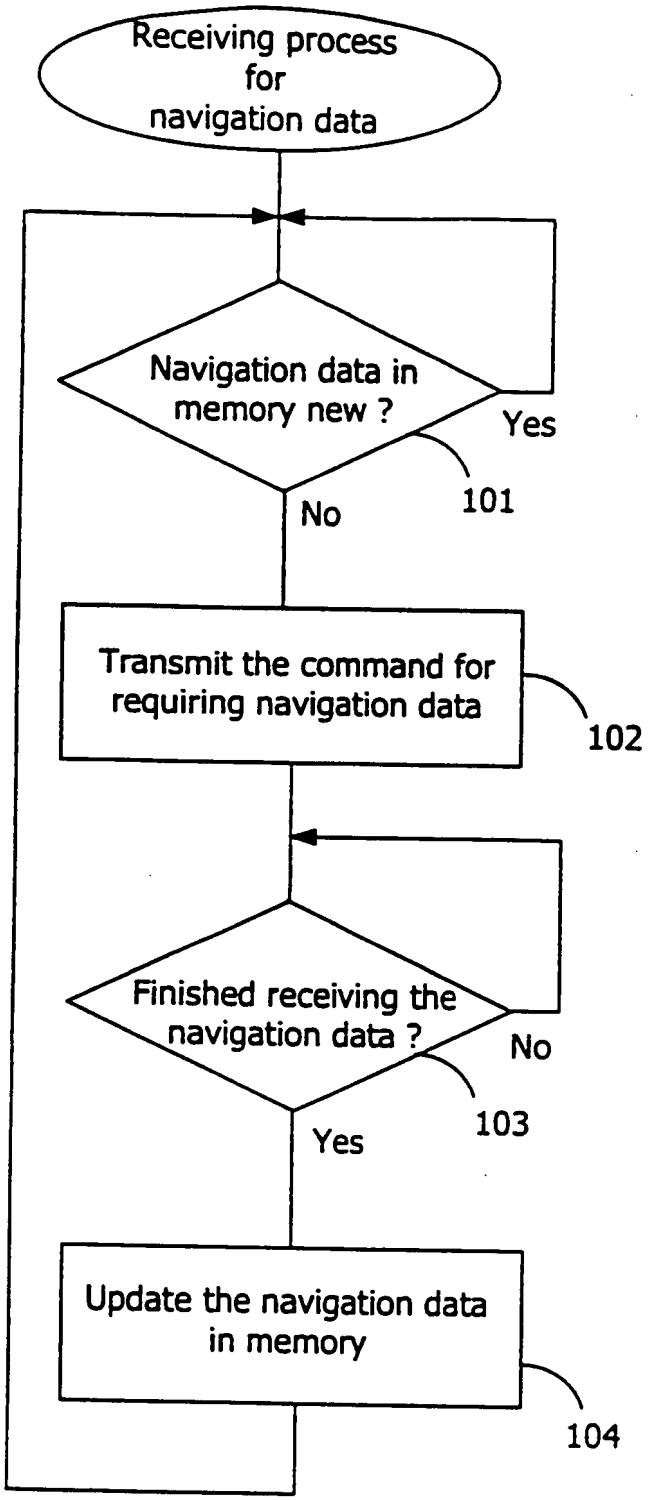
[Effects of the Invention]

As described above, with the satellite navigation system of this invention, because the navigation data, the type of data that takes the most time to collect, can be transmitted and received between a mobile station and a fixed station, even when

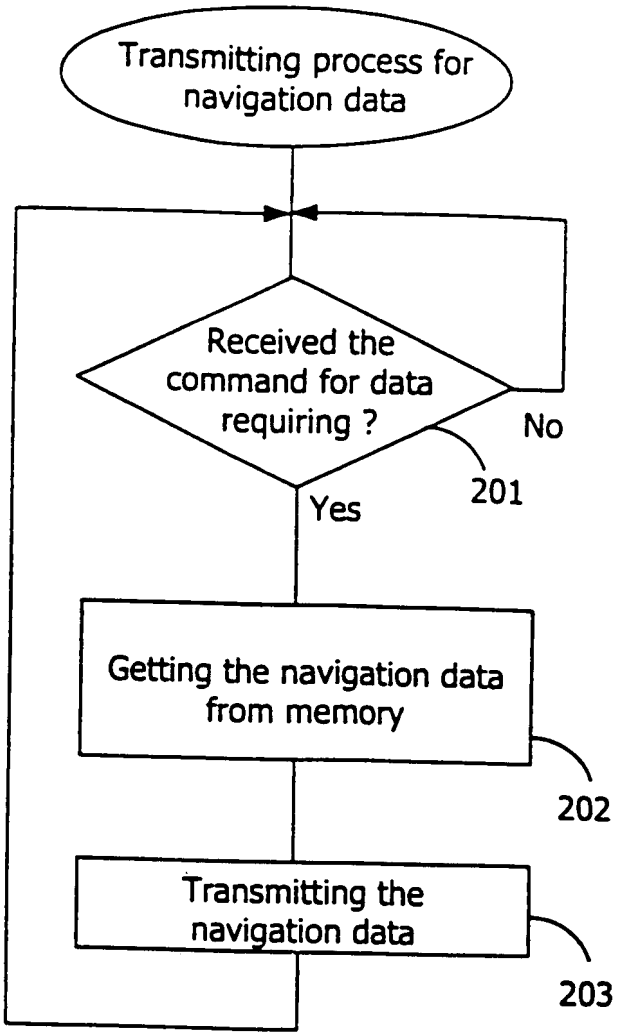
a mobile body on which a mobile station is mounted is traveling in an area where there are many obstructions, such as a city area or a mountainous area, the demodulation of navigation data can be carried out rapidly and reliably. Accordingly, there is the merit that the time during which position determination cannot be carried out due to data collection becomes extremely short, and the position of the mobile body can be displayed correctly at any time.


1
Display Device
16
11
12
13
15
Circuit for receiving
Circuit for processing
Interface
17
14
Memory
Circuit for transmitting and receiving
Circuit for transmitting and receiving
26
Display Device
21
22
23
25
27
Circuit for receiving
Circuit for processing
Interface
24
Memory
2

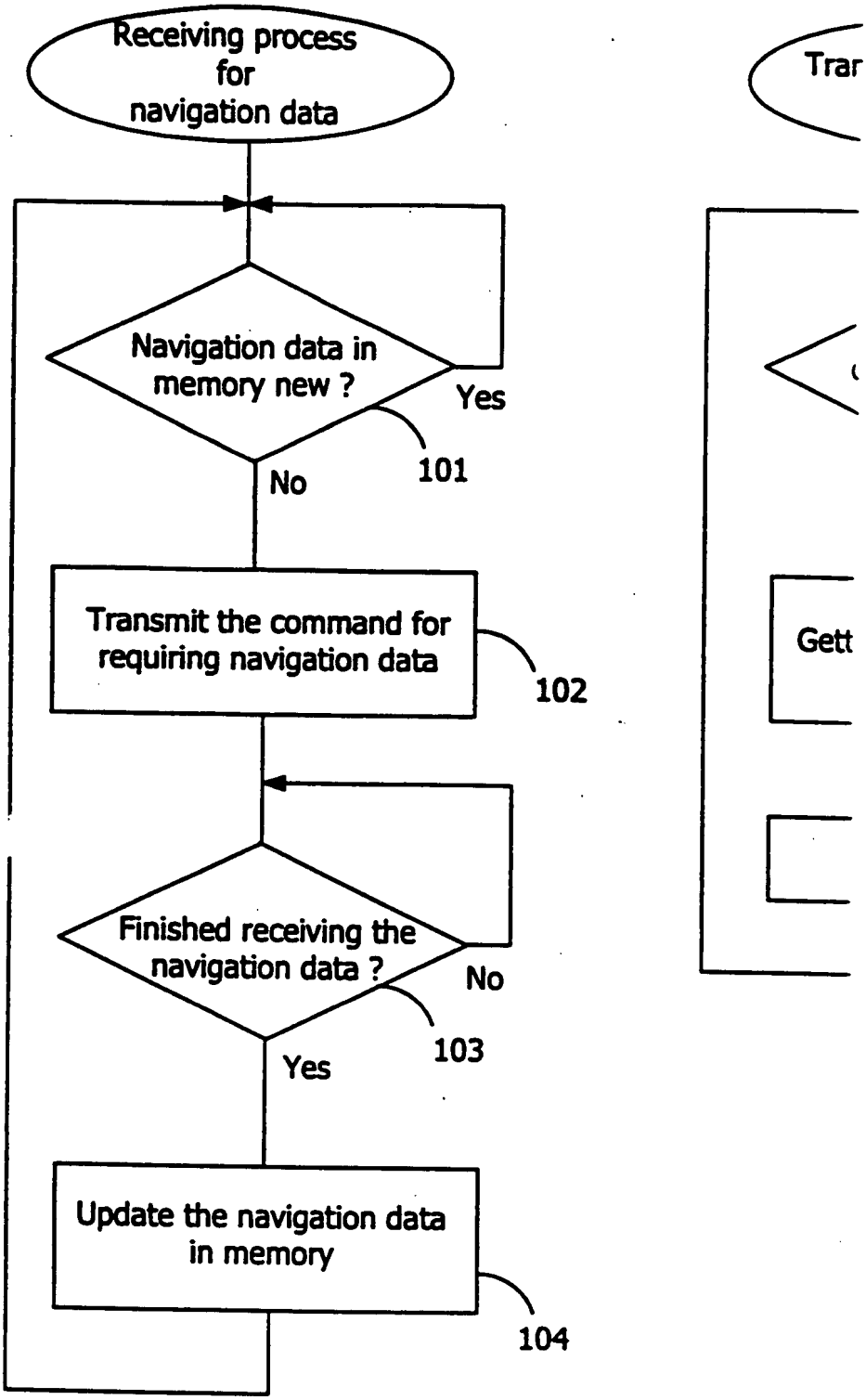
<Fig.2>


Receiving process for navigation data
Navigation data in memory new ?
Yes
No
101
Transmit the command for requiring navigation data
102
Finished receiving the navigation data ?
No
Yes
103
Update the navigation data in memory
104

<Fig.3>


Transmitting process for navigation data
Received the command for data requiring ?
No
Yes
201
Getting the navigation data from memory
202
Transmitting the navigation data
203

<Fig.2>


Receiving process for navigation data
Navigation data in memory new ?
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No
101
Transmit the command for requiring navigation data
102
Finished receiving the navigation data ?
No
Yes
103
Update the navigation data in memory
104
Trar
Gett